

MATHEMATICS DEPARTMENT  
North Carolina State University

## DIFFERENTIAL EQUATIONS SEMINAR

Wednesday, September 27, 2006  
3:00 p.m. 330 Harrelson Hall

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### **“Use level sets and relax: A new relaxation concept in topology optimization”**

Typically in topology optimization problems, but also in other shape optimization problems, one is interested in finding functions of bounded variation with binary values, say 0 and 1. The fact that the set of function values is discrete usually complicates the numerical treatment significantly (nonconvexity, unfavorable local minima, . . .). In this talk, a new relaxation concept for the above mentioned problem class is introduced and analyzed. A solution of the relaxed problem attains function values in  $[0, 1]$ . Based on the main analytical tool, the co-area formula, it will be shown that the relaxation is exact in the sense that a solution of the relaxed problem is also a solution of the original problem. Further, stability of the exactness property under additive perturbations in the objective is discussed, and convergence properties for a Tikhonov-type regularization (as the regularization parameter tends to zero) are addressed. One of the main benefits of our relaxation approach is its ability of a user-friendly implementation. Besides projected gradient flows in a level set context, we also highlight semismooth Newton methods for a fast numerical solution of the relaxed problems. The talk ends by a report on numerical tests.

**Graduate students are invited to attend.**